

WHAT IS CLAIMED IS:

1. A data transmission method for communication between first and second transmission devices transmitting/receiving a data frame by using a single transmission path, comprising the steps of:

5 detecting, at said first transmission device, that a carrier used for signal transmission of the data frame does not exist on said transmission path for confirming that said transmission path is available,

transmitting one or more data frames in sequence from said  
10 first transmission device when said carrier does not exist,

detecting, at said second transmission device, that said carrier does not exist on said transmission path for confirming that said transmission path is available when received one or more of the data frames transmitted from said first transmission device,  
15 and

transmitting one or more data frames in sequence from said second transmission device when said carrier does not exist.

2. A data transmission method for communication between first and second transmission devices transmitting/receiving a data frame via a relay device by using a single transmission path, comprising the steps of:

5 detecting, at said relay device, when received one or more

data frames transmitted from said first transmission device, an error in each of the received data frames;

setting, at said relay device, only the data frame in which no error was detected as a data frame to be transmitted,

10 detecting, at said relay device, that said carrier does not exist on said transmission path for confirming that said transmission path is available; and

transmitting one or more data frames in sequence from said relay device to said second transmission device when said carrier  
15 does not exist.

3. A data transmission method for communication between first and second transmission devices transmitting/receiving a data frame including a transmission timer value indicating a total frame time of data frames subsequent thereto by using a single  
5 transmission path, comprising the steps of:

sequentially transmitting n-data-frames (where n is an arbitrary natural number) each including the transmission timer value set to indicate (n - k) frame time (where k is an arbitrary natural number showing sequential order of transmission) from  
10 said first transmission device;

detecting, at said second transmission device that has received one or more of the data frames each <sup>said frame</sup> including said transmission timer value, the transmission timer value included in an error-free data frame among the received data frames;

15           managing, at said second transmission device, an elapse of  
the total frame time of the subsequent data frames by using the  
detected transmission timer value and managing an elapse of a time  
period by using a predetermined initial value when no transmission  
timer value is detected, for confirming that said transmission  
20 path is available; and

transmitting one or more data frames in sequence from said  
second transmission device when said transmission path is  
confirmed being available.

4.       The data transmission method according to claim 3,  
wherein

said transmission path is implemented by radio transmission  
in an arbitrary frequency band.

5.       The data transmission method according to claim 3,  
wherein

said initial value is determined as the maximum time  
required for error-free transmission of all of said data frames.

6.       The data transmission method according to claim 3,  
wherein

in said step of detecting said transmission timer value,  
the transmission timer value is detected from every error-free  
5 data frame among the data frames received by said second

transmission device; and

in said step of confirming that said transmission path is available, an elapse of the total frame time of the subsequent data frames is started to be managed every time said transmission  
10 timer value is detected.

7. A data transmission method for communication between first and second transmission devices transmitting/receiving a data frame including a transmission timer value indicating a total frame time of data frames subsequent thereto via a relay device  
5 by using a single transmission path, comprising the steps of:

sequentially transmitting n-data-frames (where n is an arbitrary natural number) each including the transmission timer value set to indicate (n - k) frame time (where k is an arbitrary natural number showing sequential order of transmission) from said  
10 first transmission device;

detecting, at said relay device that has received one or more of the data frames each including said transmission timer value, an error in each of the received data frames;

detecting, at said relay device, the transmission timer  
15 value included in an error-free data frame among the received data frames;

setting, at said relay device, m-data frames (where m is a natural number not more than n) in which no error was detected as data frames to be transmitted;

20           setting, at said relay device, the transmission timer value  
for each of the data frames set as the data frames to be transmitted  
so as to indicate  $(m - k)$  frame time;

          managing, at said relay device, an elapse of the total frame  
time of the subsequent data frames by using the detected  
25   transmission timer value for confirming that said transmission  
path is available; and

          transmitting one or more data frames in sequence from said  
relay device to said second transmission device when said  
transmission path is confirmed being available.

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8.       The data transmission method according to claim 7,  
wherein

          said transmission path is implemented by radio transmission  
in an arbitrary frequency band.

9.       The data transmission method according to claim 7,  
wherein

          in said step of detecting said transmission timer value,  
the transmission timer value is detected from every error-free  
5   data frame among the data frames received by said relay device;  
and

          in said step of confirming that said transmission path is  
available, an elapse of the total frame time of the subsequent  
data frames is started to be managed every time said transmission

10 timer value is detected.

10. A data transmission system for communication between first and second transmission devices transmitting/receiving a data frame by using a single transmission path, wherein

said first and second transmission devices each comprise:

5 a receiving portion for receiving the data frame;

a carrier detecting portion for detecting that a carrier used for signal transmission of the data frame does not exist on said transmission path; and

10 a transmitting portion for transmitting the data frame, and

said second transmission device that has received one or more of the data frames transmitted from said first transmission device detects, by said carrier detecting portion provided therein, that the carrier does not exist on said transmission path  
15 to confirm that said transmission path is available, and then transmits one or more data frames in sequence.

11. A data transmission system for communication between first and second transmission devices transmitting/receiving a data frame via a relay device by using a single transmission path, wherein

5 said first and second transmission devices each comprise:

a first receiving portion for receiving the data

frame;

a first carrier detecting portion for detecting that  
a carrier used for signal transmission of the data frame does not  
10 exist on said transmission path; and

a first transmitting portion for transmitting the  
data frame,

said relay device comprises:

a second receiving portion for receiving the data  
15 frame;

a second carrier detecting portion for detecting that  
the carrier used for signal transmission of the data frame does  
not exist on said transmission path;

an error detecting portion for detecting an error in  
20 the data frame received by said second receiving portion;

a received frame analyzing portion for setting the  
data frame in which no error was detected by said error detecting  
portion as a data frame to be transmitted; and

a second transmitting portion for transmitting the  
25 data frame, and

said relay device, when received one or more of the data  
frames transmitted from said first transmission device, detects,  
by said second carrier detecting portion provided therein, that  
the carrier does not exist on said transmission path to confirm  
30 that said transmission path is available, and then transmits one  
or more of said data frames to be transmitted to said second

transmission device in sequence.

12. A data transmission system for communication between first and second transmission devices transmitting/receiving a data frame including a transmission timer value indicating a total frame time of data frames subsequent thereto by using a single  
5 transmission path, wherein

said first and second transmission devices each comprise:

a receiving portion for receiving the data frame including said transmission timer value;

a transmission timer acquiring portion for acquiring  
10 the transmission timer value included in the data frame received by said receiving portion;

/ a transmission timer for suspending transmission for a frame time indicated by the transmission timer value acquired by said transmission timer acquiring portion/ and when none of  
15 said timer values is acquired, suspending transmission for a time indicated by a predetermined initial value;

a transmitting frame constructing portion for constructing a data frame to be transmitted including the transmission timer value so set as to indicate the total frame  
20 time of the data frames subsequent thereto; and

a transmitting portion for transmitting the data frame to be transmitted constructed by said transmitting frame constructing portion, and



25        said second transmission device, when received one or more  
of the data frames transmitted from said first transmission device,  
confirms, by said transmission timer provided therein, that said  
transmission path is available through an elapse of the time of  
suspending transmission, and then transmits one or more of the  
data frames to be transmitted constructed by said transmitting  
30    frame constructing portion in sequence.

13.    The data transmission system according to claim 12,  
wherein

      said transmission path is implemented by radio transmission  
in an arbitrary frequency band.

14.    The data transmission system according to claim 12,  
wherein

      said initial value is determined as the maximum time  
required for error-free transmission of all of said data frames.

15.    A data transmission system for communication between  
first and second transmission devices transmitting/receiving a  
data frame including a transmission timer value indicating a total  
frame time of data frames subsequent thereto via a relay device  
5    by using a single transmission path, wherein

      said first and second transmission devices each comprise:

          a first receiving portion for receiving the data

frame including said transmission timer value;

10       a first transmission timer acquiring portion for  
acquiring the transmission timer value included in the data frame  
received by said first receiving portion;

15       a first transmission timer for suspending  
transmission for a frame time indicated by the transmission timer  
value acquired by said first transmission timer acquiring portion,  
and when none of said timer values is acquired, suspending  
transmission for a time indicated by a predetermined initial  
value;

20       a first transmitting frame constructing portion for  
constructing a data frame to be transmitted including the  
transmission timer value so set as to indicate the total frame  
time of data frames subsequent thereto; and

      a first transmitting portion for transmitting the  
data frame to be transmitted constructed by said first  
transmitting frame constructing portion,

25       said relay device comprises:

      a second receiving portion for receiving the data  
frame including said transmission timer value;

      an error detecting portion for detecting an error in  
the data frame received by said second receiving portion;

30       a received frame analyzing portion for setting the  
data frame in which no error was detected by said error detecting  
portion as a data frame to be transmitted;

a second transmission timer acquiring portion for acquiring the transmission timer value included in an error-free data frame among the received data frames;

a second transmission timer for suspending transmission for a frame time indicated by the transmission timer value acquired by said second transmission timer acquiring portion,

a second transmitting frame constructing portion for constructing a data frame to be transmitted including the transmission timer value so set as to indicate the total frame time of the data frames subsequent thereto; and

a second transmitting portion for transmitting the data frame to be transmitted constructed by said second transmitting frame constructing portion, and

said relay device, when received one or more of the data frames transmitted from said first transmission device, confirms, by said second transmission timer provided therein, that said transmission path is available through an elapse of the time of suspending transmission, and then transmits one or more of the data frames to be transmitted constructed by said second transmitting frame constructing portion to said second transmission device in sequence.

16. The data transmission system according to claim 15, wherein

said transmission path is implemented by radio transmission in an arbitrary frequency band.

17. A transmission device for transmitting/receiving a data frame by using a single transmission path, comprising:

a receiving portion for receiving the data frame;

a carrier detecting portion for detecting that a  
5 carrier used for signal transmission of the data frame does not exist on said transmission path; and

a transmitting portion for transmitting the data frame, and

when received one or more data frames, detecting, by said  
10 carrier detecting portion provided therein, that the carrier does not exist on said transmission path to confirm that said transmission path is available, and then transmitting one or more data frames in sequence.

18. A relay device for relaying data transmission from a first transmission device transmitting a data frame to a second transmission device by using a single transmission path, comprising:

5 a receiving portion for receiving the data frame;

a carrier detecting portion for detecting that a carrier used for signal transmission of the data frame does not

exist on said transmission path;

10            an error detecting portion for detecting an error in  
the data frame received by said receiving portion;

          a received frame analyzing portion for setting only  
the data frame in which no error was detected by said error  
detecting portion as a data frame to be transmitted; and

15            a transmitting portion for transmitting said data  
frame to be transmitted, and

          when received one or more data frames transmitted from said  
first transmission device, detecting, by said carrier detecting  
portion, that the carrier does not exist on said transmission path  
20        to confirm that said transmission path is available, and then  
transmitting one or more of said data frames to be transmitted  
to said second transmission device in sequence.

19.    A transmission device for transmitting/receiving a  
data frame including a transmission timer value indicating a total  
frame time of data frames subsequent thereto by using a single  
transmission path, comprising:

5            a receiving portion for receiving the data frame  
including said transmission timer value;

          a transmission timer acquiring portion for acquiring  
the transmission timer value included in the data frame received  
by said receiving portion;

10            a transmission timer for suspending transmission for

a frame time indicated by the transmission timer value acquired by said transmission timer acquiring portion, and when none of said timer values is acquired, suspending transmission for a time indicated by a predetermined initial value;

15           a transmitting frame constructing portion for constructing a data frame to be transmitted including the transmission timer value so set as to indicate the total frame time of the data frames subsequent thereto; and

20           a transmitting portion for transmitting the data frame to be transmitted constructed by said transmitting frame constructing portion, and

25           when received one or more data frames, confirming, by said transmission timer, that said transmission path is available through an elapse of the time of suspending transmission, and then transmitting one or more of the data frames to be transmitted constructed by said transmitting frame constructing portion in sequence.

20.   The transmission device according to claim 19, wherein

      said initial value is determined as the maximum time required for error-free transmission of all of said data frames.

21.   A relay device for relaying data transmission from a first transmission device transmitting a data frame including

a transmission timer value indicating a total frame time of data frames subsequent thereto, to a second transmission device by  
5 using a single transmission path, comprising:

a receiving portion for receiving the data frame including said transmission timer value;

an error detecting portion for detecting an error in the data frame received by said receiving portion;

10 a received frame analyzing portion for setting only the data frame in which no error was detected by said error detecting portion as a data frame to be transmitted;

a transmission timer acquiring portion for acquiring the transmission timer value included in the data frame received  
15 by said receiving portion;

a transmission timer for suspending transmission for a frame time indicated by the transmission timer value acquired by said transmission timer acquiring portion;

a transmitting frame constructing portion for  
20 constructing a data frame to be transmitted including the transmission timer value so set as to indicate the total frame time of the data frames subsequent thereto; and

a transmitting portion for transmitting the data frame to be transmitted constructed by said transmitting frame  
25 constructing portion, and

when received one or more data frames transmitted from said first transmission device, confirming, by said transmission timer,

that said transmission path is available through an elapse of the time of suspending transmission, and then transmitting one or more of the data frames to be transmitted constructed by said transmitting frame constructing portion to said second transmission device in sequence.